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# United States Department of the Interior

GEOLOGICAL SURVEY

WATER RESOURCES DIVISION  
Great Valley Corporate Center  
111 Great Valley Parkway  
Malvern, PA 19355

April 11, 1989

Ms. Gerallyn Valls  
U.S. Environmental Protection Agency (3HW12)  
841 Chestnut Street  
Philadelphia, PA 19107

Dear Ms. Valls:

The quality assurance plan you requested for the packer testing at the Raymark Site is enclosed, along with the geophysical logs for PF-1. We will start work on April 18, 1989. If you need anything further, please let me know.

Sincerely,

CHARLES R. WOOD  
Subdistrict Chief

CRW:aln

Enclosures

cc: Albert Becher  
Robert Kay  
M. Taulo  
M. Sniapska

AR300143

## WORK PLAN

### Raymark NPL Site, Montgomery County, Pennsylvania

#### Technical Support (Packer Tests) for Superfund Site Investigation

#### 1.0 PROJECT DESCRIPTION

The Pennsylvania District of the U.S. Geological Survey will conduct packer tests of wells located at and in the vicinity of Hatboro, Montgomery County, Pennsylvania. The primary purpose of this study is to better characterize the location of the major yielding zones and sample the fluid intercepted in boreholes. This Work and Quality Assurance/Quality Control Plan is submitted in accordance with Interagency Agreement Number DW 14933394-01-0.

#### 2.0 SITE DESCRIPTION AND HISTORY

The Raymark site is on Jacksonville Road in Hatboro, Montgomery County, Pennsylvania, about six miles north of Philadelphia. Milford Rivet and Machine Company, Inc., currently a subsidiary of Raybestos Manhattan (now known as Raymark Corporation), owned and operated the facility from 1947 until 1981. The company manufactured rivets and fasteners. The facility is currently owned by Telford Industrial Development Authority and is leased and operated by Penn Fasteners, also a manufacturer of rivets and fasteners.

Allegedly, four lagoons located at the rear of the site were used from 1948 to 1972 for waste disposal of solvents, acids and heavy metals. In 1972, the lagoons were taken out of operation by excavating the waste and filling the pits with clean fill and berm material.

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In the manufacturing of metal rivets, Milford Rivet utilized trichloroethylene (TCE) to degrease nonporous ferrous and nonferrous parts. The TCE was stored in outdoor above-ground storage tanks, which have been removed from the facility.

In 1979, Hatboro Borough Water Authority discovered that eight of their municipal water supply wells were contaminated with volatile organic compounds (i.e., TCE). The contaminated wells have been either taken off line or equipped with necessary treatment systems. The discovery of contaminated wells prompted an extensive investigation by EPA, DER, and the Hatboro Borough Water Authority, of the possible sources of contamination. Periodic sampling has been ongoing from 1979 to the present. The Raymark site has been identified as a source of ground-water contamination to the aquifer and some of the Hatboro municipal wells. The Fischer & Porter Company facility, which is an NPL site, is also a contributor to the area ground-water contamination that has impacted the Hatboro municipal wells.

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## 2.1 Hydrogeologic Setting

The site is underlaid by interbedded arkose, arkosic conglomerate, feldspathic sandstone, red shale, and siltstone of the Stockton Formation of Triassic age. The beds dip north to northwest at about 10 degrees. The site is in the middle arkose member, but the contact with the lower arkose member is penetrated by wells at a depth of about 150 feet below land surface.

Most ground water moves through very narrow secondary openings, along bedding planes, joints, and faults. These openings are well developed only in a few thin beds. The ground-water system consists of a series of alternating tabular aquifers and intervening low-permeability rocks, which dip northwestward at about 10 degrees. Nearly all deep wells drilled into this series of tabular aquifers tap water from more than one aquifer and thus are multiaquifer wells. Although compressive loading tends to close the water-bearing openings as depth increases, the thin beds probably yield significant amounts of water to wells to a depth of at least 1,000 feet. Wells obtain most of their water by dewatering large volumes of rock in the vicinity of the pumped well. Specific yields from the zone of freshwater circulation are low, probably not much more than 1 percent. Aquifer test data show that maximum drawdown occurs along strike from the pumped wells. Average overburden thickness is probably about 10 feet.

## 2.2 Purpose and Scope of Packer Testing

Packer testing will provide confirmation of geologic and driller log data and data on the old production well for which no log data exist. They will define the location, yield, and quality of water-bearing zones.

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A packer test will be performed on well PF1 near the Raymark Site. Two or three zones identified in the geophysical logs will be straddle packed off in 20-foot intervals and pumped at rates not in excess of 50 gallons per minute for not more than 2 hours for each zone. Head changes in the pumped interval will be measured periodically to an accuracy of not less than plus or minus one foot. The work will be performed in accordance with the Quality Assurance/Quality Control Plan herein contained and the Health and Safety Plan developed for the site. Copies of head and discharge data for each interval tested will be given to USEPA within 7 days of the completion of testing. If requested by USEPA, a final report will be written and given to USEPA that interprets the data from each borehole and relates the findings to the hydrogeology of the site. If the geophysical logging and location of the well indicate that packer testing of well H2 is feasible, this well will also be packer tested. USEPA or its contractor will collect water samples during the packer testing.

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### 3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

Packer tests are to be conducted by inflating BASKI packers with nitrogen above and below each zone to be investigated and pumping water from between the packers to the surface with a submersible pump. Head changes above, between, and below the packers will be measured using Microswitch transducers that transmit data to a Campbell Scientific data logger (CR7). The accuracy and precision of the measurement are a function of the design characteristics of the instrumentation and calibration procedures described in sections 2, 4, and 8.

### 4.0 MEASURING PROCEDURES, CALIBRATION PROCEDURES, AND FREQUENCY OF MEASUREMENT FOR PACKER TESTING

Operation of the packer string is described in the attached material from BASKI and written correspondence from R. T. Kay (1989). Manual water-level measurements (made with a steel tape or electric tape) above the packer will be used to validate the data integrity. A log will be kept of the zones packed off. Discharge measurements by meter will be verified by a volumetric measurement. Head measurements will be made at one-minute intervals.

### 5.0 SAMPLING PROCEDURES

Sampling will be done by USEPA's contractor, who will follow USEPA approved procedures.

### 6.0 SAMPLE CUSTODY

Sample custody is the responsibility of USEPA's contractor.

### 7.0 DATA REDUCTION AND REPORTING

Head changes and discharge measurements are processed by the data logger, and the output will be reduced and paper copy provided to the USEPA.

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## 8.0 INTERNAL QUALITY CONTROL CHECKS

Static head will be observed before packers are set and immediately afterwards to verify that packers are properly seated. Head differences will be observed during pumping to assure that packers do not malfunction.

## 9.0 PERFORMANCE AND SYSTEM AUDITS

Not applicable to packer testing.

## 10.0 PREVENTIVE MAINTENANCE

The electronic and mechanical systems are checked completely prior to moving to the data collection site to make certain they operate normally. Replacement parts are carried in the truck or are available routinely within three days of a request.

## 11.0 ROUTINE PROCEDURES TO ASSESS THE ACCURACY AND COMPLETENESS OF DATA

Recovery data will be collected for 5 minutes after pumping ceases, to verify drawdown results. Also see sections 2, 4, and 8.

## 12.0 CORRECTIVE ACTION

Data that are incomplete or of poor quality will be noted and the reasons discussed with the site manager. Borehole or other environmental conditions may prevent the acquisition of acceptable data.

Needed adjustments or minor repairs of the packer equipment will be made by the operator as necessary. Problems that require more extensive corrective efforts will be discussed with the site manager and the appropriate USGS personnel before any decision is made.

AR300149

TO: Charles R. Wood, Subdistrict Chief, Malvern, PA (CRWOOD)  
CC:  
From: Robert T. Kay, Hyd, Urbana, IL (PTKAY)  
Date: Apr. 06, 1989 15:24:22

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April 7, 1989

To: Charles R. Wood, Subdistrict Office Chief, WRD, Malvern, PA  
From: Robert Kay, Hydrologist, WRD, Urbana, IL

As per our conversation on April 6, I am sending all of the pertinent information I can find on the equipment we will probably be using during the packer testing.

Packers are manufactured by BASKI. They are fixed end packers, 4 inches in diameter, and approximately 2 feet in height. Packers will be inflated with Nitrogen gas.

Transducers are manufactured by Microswitch, we assemble them ourselves. The transducers are temperature compensated and rated at 0-60 or 0-100 psi. The full scale output of the 0-60 psi transducers is 58 to 62 millivolts and the sensitivity is typically 2.25 psi per millivolt. The full scale output of the 0-100 psi transducers is 98 to 102 millivolts and the sensitivity is typically 2.25 psi per millivolt. Essentially, these transducers will only be useful if there is a lot of drawdown. We have the capability to hook up transducers to the zones below, within, and above the packed off interval. We can back up the drawdown measurements in the zone above the packed interval with manual measurements.

The data logger is a Campbell Scientific CR7. The data logger can sample all three transducers at the same time and keep track of the total flow and flow rate. The data logger can sample will be able to take a reading every second. The data logger has an LCD display and will be attached to a SM memory module.

An in-line sampling port is currently part of the system. We have in excess of 150 feet of discharge line available. We have a SIGNET Scientific in line totalizing flowmeter available which can be calibrated against the time required to fill a 55 gallon drum.

The pump we will be using will probably be a Red Jacket 5HP-3 phase submersible pump. Manufacturers specifications indicate that this pump can deliver 30 gpm at a depth of 150 feet.

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I will be sending you a copy of an orientation paper put out by BASKI. This paper gives rather general information on packers so I don't know how useful it will be. You should receive this paper by Monday. Because the paper is promotional material, not a published article, I can provide no reference citation. I found another general article on packers in the April 1986 issue of Water Well Journal page 49.

If you wish to call BASKI, the number I have is 303-235-0740. This number is from 1987 and may not be current.



APR 10

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BASKI PURGE PACKER

INVOICE 2647

SERIAL 2647.1 THRU 2647.12

DO NOT EXCEED THE 100 PSI DIFFERENTIAL PRESSURE RATING OF THIS PACKER FOR EITHER THE TOP END OR THE BOTTOM END OF THIS PACKER

FOR DOWNHOLE PUMPING THE (PSI) INFLATION AT THE PACKER IS:

FOR PUMPING (OUT): MULTIPLY the submergence pressure by 1.3 and ADD 35 PSI (to stretch the rubber to 4.0" O.D.).

The top end differential pressure is the difference between the inflation pressure and the top hydrostatic pressure.

The bottom end differential pressure is the difference between the inflation pressure and the bottom downhole pumping fluid pressure.

READ ALL ATTACHED INFORMATION BEFORE USING

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Thank you for purchasing a Baski Inflatable Packer. We hope that you are satisfied with its performance and if you have any questions or problems, please contact us. The following information will help you use the packer in the most effective way.

#### CAUTION

Always exercise caution with packers and peripheral equipment. When using compressed gas to inflate packers, make sure the cylinder is chained properly to prevent falling over, and that a proper regulator for inflation pressure is installed. Before attaching the regulator, "crack" (quickly open and close) the cylinder valve to clean out any foreign matter which might be in the valve. All fittings, valves and inflation tubing must be of a pressure rating consistent with the pressures for which the packer was designed. Never inflate a packer in the open or on the ground. Never exceed the maximum Differential Pressure rating (DP) of the packer. Be sure the strength of the pipe string is sufficient to hang the packer and any other optional pumps and probes that may be attached. The sliding end of sliding end packers always goes down. When deflating packers always wait long enough for full deflation. If necessary, place the inflation tube in a pail of water to determine when no more gas is escaping, i.e. no bubbles. Failure to do so can result in damage to the element. Packer failure is often associated with misapplication: be sure the packer is designed for the specific application in the field. A small amount of silicone oil can be injected into the packer through the inflation port to lubricate the o-rings if necessary. When installing packers, allow the support pipe to move as the packer is being inflated. This is necessary since the packer normally pulls down during inflation. The amount of movement is dependent on packer size and construction, and hole size. Failure to allow for movement is a major cause of elements pulling out from their ends.

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## GENERAL INFORMATION

Generally, packers are designed with the following in mind:

1. the depth to be set in the well;
2. whether the packer is used in a cased hole (where a shorter element can be used against the smooth wall), or an open bore (where the conditions vary from hard unfractured, to soft, to fractured, the latter requiring sliding end packers);
3. the diameter of the uninflated packer which can easily pass through the well without getting stuck, while providing a sufficient inside diameter to meet pumping requirements, or pass probes.
4. the differential pressure which is expected (more will be said about this later);
5. a seal length which incorporates economy and downhole requirements to properly seal and hold to the borehole walls. Elements are generally 20", 40", and 60" of visible rubber. The seal length varies from 6" to 24" less than these nominal lengths, depending on the amount of expansion.
6. temperature and fluid compatibilities with the materials of construction of the packer. Packers are built for applications requiring PVC and 316 stainless, or all stainless and Viton covered, as well as less exotic applications requiring only steel or aluminum.

When choosing between a fixed end or a sliding end packer the customer must consider the potential for failure. If the indirect costs of failure are high (such as rig time), then sliding end packers should be chosen. If, however, failure costs are low or reuse is not possible (as in some cementing applications), then fixed end packers are more economical. Fixed end packers have no reinforcing in the middle of the rubber element: i.e. there is only rubber. Therefore, fixed end elements are much weaker when inflated in the open air.

Versatility of the packer is an original design consideration. Two packers may have the same outside diameter and ply reinforcing, but one may be designed to expand more than the other (to accommodate a wider variety of hole sizes). Such a packer will blow up at a lower pressure when unrestrained (as in a washed out borehole) than a packer with a smaller expansion ratio (expansion ratio = (maximum inflated outside diameter) / (uninflated outside diameter)). Further, any packer is stronger as the actual required expansion ratio for a specific hole approaches 1 (one): that is, the packer does not expand much.

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### DESCRIPTION

Inflatable packers are either fixed end or sliding end. If it is not evident by inspection the packer may be inflated on the ground with 25 to 50 PSI to visually determine if there is movement of one of the ends. Never inflate to higher pressures in the open. The sliding end must always be in the down position. Packers with replaceable o-rings will have either a threaded ring with slots on each end, or the end cap will unscrew. While most packers will have an inflation tube fitting on the top end, some will have one also on the bottom end. Occasionally packers will be inflated directly by pressurizing the base pipe.

### CARE AND PREPARATION

Avoid letting dirt enter into the packer through the inflation port. Blow out inflation tubing first before connecting to the packer. Read the cautionary information at the beginning of this paper.

### INFLATION PRESSURE

If using liquid to inflate, the packer pressure is the sum of the surface inflation pressure and the pressure of the column of fluid. Each foot of water exerts about 0.433 PSI. When the static water level is quite low, it is possible the packer will not deflate if liquid inflation is used. In such a case, a double line should be used, both connected to the packer inflation port with a "Y" type connector. To deflate, pressurize one line to blow out the other. If using gas to inflate the packer, the packer pressure is the same as the surface pressure. Consult the beginning of this article for the proper inflation pressure to be used with each individual packer.

### SETTING THE PACKER

Be sure to allow some movement of the pipe string when inflating the packer. Failure to do so can create excessive stresses in the ends and can cause the element to pull out from the end of the packer. Be sure the sliding end goes down first in the hole.

### UNSETTING THE PACKER

The packer must be full, deflated before attempting to move it in the casing (or borehole). If necessary, remove the surface end of the inflation line and place in a bucket of water until no more bubbles come from it, indicating full deflation.

The information and data presented herein are typical or average values and are not a guarantee of maximum or minimum values. Applications specifically suggested are for the purpose of illustration to enable the reader to make his own evaluation, and are not intended as warranties, either expressed or implied, of fitness for these or other uses.